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## NMRC Welcomes New Commanding Officer - Fairwinds and Following Seas to Capt. John W. Sanders III

Story by Mikelle D. Smith, Naval Medical Research Center Public Affairs



Naval Medical Research Center (NMRC) Commanding Officer, Capt. Jacqueline D. Rychnovsky (right) salutes former NMRC Commanding Officer, Capt. John W. Sanders III (left) as she assumes command during a change of command ceremony held in the Albert R. Behnke Auditorium, July 17. (Photo by Mikelle D. Smith, Naval Medical Research Center Public Affairs)

SILVER SPRING, Md., - Naval Medical Research Center (NMRC) held a Change of Command Ceremony on behalf of the arrival of a new commanding officer subsequently saying farewell to former NMRC Commanding Officer, Capt. John W. Sanders III as he retired, July 17.

A host of military officials attended and participated in the event including Director, Medical Resources, Plans and Policy Division, N0931, Chief, Navy Dental Corps, Rear Adm. Stephen M. Pachuta, who was

the presiding officer and guest speaker, as well as former NMRC commanding officers and personnel.

"There is no other organization that does a change of command quite like the Navy," said Pachuta, during his speech. "Great teams need great leaders to create the vision, set the tone [and] point the direction ... [Captain Sanders] has been that kind of leader. His exceptional leadership was directly responsible for many wonderful

(continued on page 3)

## NMRC Commanding Officer Message



These first few weeks have been a profound experience for me as I take command of the Naval Medical Research Center. It started on the first day I arrived at the quarter deck in Building 503, to check in and receive my temporary badge. As I left the quarter deck and began walking down the hall to the NMRC front office I paused at the display of Senator Daniel K. Inouye. Looking at his Medal of Honor, his picture, the tribute plaque acknowledging his service as a solider, his indomitable spirit, and his untiring efforts supporting military medicine and research and development, reminded me he wanted to make sure more lives would be saved on future battlefields.

As the senator's Nurse Corps Legislative Fellow for a year beginning in 2009 I had the opportunity to work almost daily with him and his staff and see first-hand his commitment to military healthcare, research and development, and the advancement of military nursing research. This fellowship provided me an opportunity to broaden my experience and knowledge in the operations and organization of Congress and understand the national policy development process. I know the senator would be so proud of the many accomplishments and the current work being done in the Daniel K. Inouye Building in Silver Spring, Maryland, at the Naval Medical Research Center, the laboratory and the global enterprise, and including the Walter Reed Army Institute of Research.

These past few weeks have been fascinating as I received the turnover from the NMRC research and administration directorates. I have always been so impressed and have the greatest respect for the ongoing research throughout our global research enterprise, and seeing it first-hand leaves me in awe of what is being done. It is every nurse researcher's dream to be offered such an assignment as this. To all enterprise staff, as we transition to Naval Medicine West, we will stay current to our mission - research, development testing and evaluation. We will face the known and unknown challenges together, but our focus will always be finding solutions for the health and medical issues to support the men and women of the Navy and Marine Corps in all operational settings. It is an honor to assume command.

**NMRC Commanding Officer Sends,  
Jacqueline D. Rychnovsky, CAPT, NC, USN**

## NAMRU-6 Commanding Officer Message

For my last column as a commanding officer I wanted to talk about the future. The 2014 – 2015 outbreak of Ebola in West Africa and recent spread of MERS-COV in South Korea serve as a warning to all that a major pandemic is coming and the price to pay for readiness is eternal vigilance. So after four years living and working abroad at what is essentially one of the Navy's overseas infectious disease weather buoys, I have to ask myself how ready are we for "the big one." In truth I think the DoD response, and particularly, Navy Medicine's response to the Ebola outbreak last year showed we are extremely capable and can get diagnostics on the ground and answer a question rapidly. In addition NAMRU-6 along with the other NAMRUs, stocks primers for the rapid diagnosis of all the major pathogens circulating globally including avian flu, MERS, Zika virus, Chikungunya, and Ebola.

The addition of full genome sequencing to our lab, gives NAMRU-6 the capability to rapidly do pathogen discovery in the face of a new outbreak. This technology capably demonstrated itself when Dutch researchers discovered MERS-COV in a matter of days in 2012. The hitch remains communication and specimen movement between countries. To answer this issue, SOUTHCOM, DTRA, The Peruvian Navy and NAMRU-6 sponsored a regional conference on Biosecurity in June with public health and military medicine participants from the majority of countries in the SOUTHCOM AOR. The participants spent a week doing tabletop simulation exercises and discussing challenges to containing the spread of disease such as disasters, or large international sporting events like the World Cup or the Olympics. These types of exercises and the networking involved serve to increase communication between nations at the grass roots and markedly increase regional response capabilities in the event of a developing pandemic. It is much easier to pick up the phone and dial a colleague you know to ask for diagnostic assistance than it is to blindly search the internet. While there are many challenges remaining regarding the movement of diagnostic reagents and specimens across international borders, the work of the overseas NAMRUs to have diagnostic capabilities at the ready and to engage regional partners with training and networking capacities is slowly building a highly capable global network of surveillance and response to pandemics that will ensure we are all safe from these threats in the future.



**NAMRU-6 Commanding Officer Sends,  
Kyle Petersen CAPT, MC, USN**



(continued from page 1)

accomplishments of this command and many of the subordinate commands part of NMRC. Additionally, I have nothing but the greatest respect and admiration for [Captain Rychnovsky] ... for her service, her leadership and commitment to military health and Navy Medicine. She is incredibly well-prepared to lead NMRC ... she brings with her a wealth of knowledge, talents and expertise, and she is absolutely the right person to lead this team and continue to build on Capt. Sanders many accomplishments.”

As is customary during a Navy change of command ceremony, Sanders and Rychnovsky read their official Navy-issued orders prior to being relieved and assuming command.

“I relieve you Sir,” said new NMRC Commanding Officer, Capt. Jacqueline D. Rychnovsky to Sanders as command-control changed hands during the ceremony. Prior to becoming the NMRC Commanding Officer, Rychnovsky served as Naval Health Research Center Commanding Officer, located in San Diego.

“It is an honor to assume command today,” said Rychnovsky. “With Capt. Sander’s departure, I am being left with extremely big shoes to fill ... to the staff of NMRC, as we transition and realign ... we will stay true to our mission -- to conduct health and medical research, development, testing, evaluation and surveillance and deployment readiness of DoD personnel worldwide.”

As Rychnovsky acknowledged her new roles as NMRC Commanding Officer, subsequently Sanders was honored for 23 years in the Navy and his time at NMRC receiving numerous awards and accolades, which were presented by Pachuta and a host of NMRC officers including NMRC Executive Officer, Capt. Eric Hall, Cmdr. David Brett-Major, Capt. (SEL) Sheri Parker, Lt. Cmdr. Matthew Casper, Cmdr. Michael Cassady and Lt. James Regeimbal.

“Capt. Rychnovsky, I am so jealous,” said Sanders as he gave his last speech before



Naval Medical Research Center Commanding Officer, Capt. Jacqueline D. Rychnovsky addresses those in attendance to the change of command ceremony as she assumes command. (Photo by Mikelle D. Smith, Naval Medical Research Center Public Affairs)

retiring. “I would happily switch places with you taking command ... this is such a tremendous command and I have been regularly amazed to be part of it. Just this week, I was floored to see a photo that had been hidden away showing the Mercury Seven astronauts completing their physiology testing here. This command is not just about its history, but about continuing to save lives and set the framework for research and development in the Navy.”

During his speech, Sanders spoke to the researchers and command support personnel at NMRC, doing work directly related to enhancing the lives of service members throughout all branches and continuing to press forward with finding the next big medical research breakthrough.

Finally Sanders addressed his family, thanking his wife, two daughters and son for keeping him centered throughout his 23 years of service, as well as his parents, in-laws and siblings for their unfailing support.

“This is our retirement from the Navy and we are a Navy family,” said Sanders as he spoke to his loved ones. “I realize it has

been a stress on you, but you have been resilient and balanced as you have grown up in the Navy, and I appreciate how you have embraced it as part of who we are as a family. I hope we always have these Navy memories to cherish and make many more as time passes. Though I am saddened by today’s events, I cannot imagine a better place to retire than NMRC. Thank you all for 23 wonderful years.”

Below: Capt. John W. Sanders III escorts his family as he retires from the Navy after 23 years of service. (Photo by Mikelle D. Smith, Naval Medical Research Center Public Affairs)



# NMRC Senior Enlisted Leader Retires

Story by Mikelle D. Smith, Naval Medical Research Center Public Affairs



SILVER SPRING, Md., - A retirement ceremony was held in the Albert R. Behnke Auditorium at Naval Medical Research Center (NMRC) for the Command Senior Enlisted Leader, Hospital Corpsman Chief Jerrold Diederich, July 10.

Diederich's family, along with friends and fellow shipmates, attended the ceremony. Also in attendance were NMRC Commanding Officer, Capt. John W. Sanders; Naval Medical Research Unit-San Antonio (NAMRU-SA) Commanding Officer, Capt. Elizabeth Montcalm-Smith; Chaplain, Cmdr. Barry Metzger; Master of Ceremonies, Hospital Corpsman Master Chief (FMF) David Hall and a host of supporting military personnel.

"Chief Diederich has been a vital part in the everyday functions and mission here at NMRC," said Sanders. "His devotion to

the junior enlisted and the junior officers can't be matched and I know he will be truly missed by many throughout the command."

Diederich received various awards on behalf of his time at NMRC from the Chiefs Mess; the Wardroom; President of the United States of America, Barack Obama; Governor of Missouri, Jay Nixon and other exceptionally noteworthy accolades signifying the time he spent serving in the United States Navy.

As the ceremony continued, Diederich shared his appreciation and devotion for all those who made a difference throughout his 24-year career.

"I want to thank Captain Sanders and Captain Montcalm-Smith for being amazing leaders during my time here," said Diederich. "Captain Sanders and I

basically got here at the same time and I honestly did not want to have another retiring officer."

During the end of the ceremony, Diederich surprised Montcalm-Smith with an end of tour award for her time serving as Executive Officer at NMRC, as well as presented Hospital Corpsman 1<sup>st</sup> Class (FMF) Yusupha Kah and Hospital Corpsman 1<sup>st</sup> Class Mark Salvador each with one of his anchors encouraging them to continue striving to become part of the Chiefs Mess and to never give up.

His personal awards include the Defense Meritorious Service Medal; Joint Service Commendation Medal; Navy and Marine Corps Commendation Medal (five awards); Navy and Marine Corps Achievement Medal (three awards); and, Navy Good Conduct Medal (six awards).



# Investigating Chemical Exposure at High Altitudes in High Performance Aircraft

Story by Lt. Cmdr. Carlis Brown (NAMRU-Dayton) and Dr. Deirdre Mahle (U.S. Air Force 711 HPW/RHDJ)



(Left to right) Dr. Deirdre Mahle (711HPW/RHDJ/Deputy Branch Chief), Mr. Richard James (NAMRU-D/Program Manager), and Lt. Cmdr. Carlis Brown (NAMRU-D/Department Head, Inhalation Toxicology) have been collaborating to investigate chemical exposure at high altitudes in high performance aircraft. (Photo courtesy of NAMRU-Dayton Public Affairs)

DAYTON, Ohio - The U.S. Air Force has been identifying potential contributing factors to episodes of suspect hypoxia seen in pilots during training missions.

In-flight emergencies with high performance aircraft indicate a gap in knowledge of stressors in the environment and impact on physiology and toxicology.

The 711th Human Performance Wing (HPW), Molecular Bioeffects Branch (RHDJ) has teamed with the Naval Medical Research Unit-Dayton (NAMRU-D) to further investigate these gaps related to chemical exposure at high altitudes. One

area of research is the effects of volatile organic chemicals (VOCs) that have been detected as a cockpit contaminant, toluene is one example.

Toluene is a chemical with a good scientific exposure database that can easily be measured in blood and tissues and it has a known physiologically based pharmacokinetic (PBPK) model for the human exposure as well as a corollary PBPK laboratory model.

In addition, toluene has been shown to have a link to hypoxia in some studies, which increases its relevance to this study.

NAMRU-D was asked to develop a system that could simulate the inhalation exposure of toluene at high altitudes in a laboratory model.

Such a system would duplicate conditions experienced in flight and allow the Air Force to determine whether or not changes in altitude will significantly increase the uptake of VOCs compared to exposures at normal ambient atmospheres.

# U.S. NAMRU-6 Exploring Collaborations with Universidad de Los Andes, Colombia

Story by Lt. Cmdr. Craig Stoop, NAMRU-6 Public Affairs



LIMA, Peru - The U.S. Naval Medical Research Unit No. 6 (NAMRU-6) conducts infectious disease research across the SOUTHCOM area of responsibility. To meet this regional mission, NAMRU-6 partners with militaries, industry and universities in Peru, and in countries across Latin America.

A team led by the NAMRU-6 Commanding Officer Capt. Kyle Petersen, traveled to Bogota, Colombia, to the Universidad de Los Andes (UniAndes) to further collaborative efforts in Colombia, May 20 – 22.

The NAMRU-6 team toured the campus and participated in several presentations highlighting NAMRU-6's and the faculty's respective research activities.

"We want to identify those areas of common interests and establish protocols where our two missions meet, for example having several Ph.D. students travel to NAMRU-6 to complete their degree requirements," said Petersen. "In the future NAMRU-6 plans to help UniAndes establish a field epidemiology program for its medical school ... UniAndes will assist NAMRU-6 in conducting research in Colombia on military relevant concerns. UniAndes is a world class university, and I was very impressed with their dedication to teaching and the state-of-the-art labs. I am very excited about future collaborations; it will ensure a steady pipeline of top scientists from UniAndes to NAMRU-6, markedly improving our bioinformatics capabilities, and strengthen our collaborative network of research in the region."

The Universidad de Los Andes, Bogota, was founded in 1948 and is Colombia's first secular, private university. It is ranked fifth among all South American universities and has 13,000 undergrads, 3,200 masters and 500 Ph.D. candidates.

A requirement of the university is all Ph.Ds must spend six months abroad before defending their thesis and are funded to travel by COLCIENCIAS, a Colombian national science funding agency, similar to the U.S. National Science Foundation.

"There are many expert faculties at the university with 29 professors in the Department of Biology alone," said Petersen. "The faculty has broad interests, but many are aligned with NAMRU-6 including studying zoonotic pathogens of wild birds, *Leishmaniasis*, insect vector behavior and bioinformatics."

NAMRU-6 conducts research on and surveillance of a wide range of infectious diseases of military or public health significance in the region, including malaria and dengue fever, yellow fever, viral Encephalitides, *Leishmaniasis*, and enteric diseases such as shigellosis and typhoid fever.

NAMRU-6 partners with the Peruvian Ministries of Defense and Health and works closely with prestigious universities like Cayetano-Heredia and San Marcos. NAMRU-6, also has a close and productive relationship with Ministries of Defense and Health, universities and NGO's throughout Latin America as well as with USAID, U.S. CDC, U.S. NIH, PAHO, and a number of U.S. universities.

These partnerships yield a robust research agenda that includes work in prevention strategies, clinical management trials, immuno- and molecular rapid diagnostics, epidemiology, and ecology as well as projects measuring the social and economic impact of disease.



# NAMRU-Dayton Invited to Share Key Research Capabilities at University of Cincinnati

Story courtesy of NAMRU-Dayton Public Affairs

DAYTON, Ohio - Four environmental health effects scientists from the Naval Medical Research Unit-Dayton (NAMRU-Dayton) provided presentations on the labs core capabilities and research programs to University of Cincinnati (UC) faculty members, June 5.

The invitation came from Dr. James Lockey, pulmonologist at the University of Cincinnati and a member of the Defense Health Board Deployment Pulmonary Health Committee, following his visit to NAMRU-Dayton in December of last year.

The presentations included Dr. Karen Mumy's *Evaluation of the Toxicity of Alternative Jet Fuels for Military Use*; Dr. Brian Wong's *PM Inhalation Studies: Toxicity assessment of fire extinguishing powder and Southwest Asian particulate matter and waste disposal combustion emissions*; Mr. Arden James' *Generating and Analyzing Particulate Matter (PM) for in vivo Inhalation Exposure Testing*; and *Inhalation Toxicity of F-22 Cockpit Contaminants in Rats including Altitude Change as a Confounding Factor: Development of the Exposure Systems and Validation Efforts*; Lt. Cmdr. Carlis Brown's *Evaluation of Jet Fuel and Sound Exposure*.

In addition to the four presentations on specific research, NAMRU-Dayton Executive Officer, Capt. Rees Lee, and NAMRU-Dayton Director of the Environmental Health Effects Research, Dr. Michael Gargas presented the command brief.

The 20 UC faculty members



represented areas such as pulmonary health, environmental health and neurophysiology programs at the Cincinnati Children's Hospital Medical Center, and programs at the UC College of Engineering. Scientific conversations were in full swing between each NAMRU-Dayton presentation.

When asked if there are plans for future communications with the UC faculty, Gargas indicated, "Most certainly." He added that NAMRU-Dayton looks forward to continued information exchanges and plans to invite the UC faculty to NAMRU-Dayton in the near future.

The mission of the NAMRU-Dayton Toxicology Directorate is to conduct basic and applied toxicology research to assess the risk, or reduce uncertainty in the risk, posed to Department of Defense (DoD) personnel, as well as civilian populations, potentially exposed to chemical contaminants and certain physical agents associated with DoD systems and operations.

# NSMRL Hosts Institute for Science Instruction and Study Fellowship Program Participants

Story courtesy of NSMRL Public Affairs



Naval Submarine Medical Research Laboratory (NSMRL) hosted Southern Connecticut State University (SCSU) Institute for Science Instruction and Study Fellows (teachers enrolled in the program), June 25. (Photo courtesy of NSMRL Public Affairs)

GROTON, Conn. - Naval Submarine Medical Research Laboratory (NSMRL) hosted Southern Connecticut State University (SCSU) Institute for Science Instruction and Study Fellows (teachers enrolled in the program), June 25.

The Fellowship Program is a six-year certification program at SCSU, designed to keep secondary school science educators current with science as it is done in the laboratories of industry, research institutions and in the field.

Mr. Gennaro Frumento, Program Faculty, thanked NSMRL for hosting the teachers and providing an overview of the program.

“The program allows the fellows the opportunities to interface and interact with researchers doing investigations in a variety of disciplines,” said Frumento. “It is through this unique approach that the teachers of science can enter and begin to understand the realm of ‘doing science,’ utilizing their experience as a stepping stone and model for science classroom activities that are exciting, authentic and emulate the spirit of research.”

Dr. Jerry Lamb, NSMRL Technical Director, provided an overview of the lab and a presentation on the current work being conducted on Submarine Team Performance and Team Fatigue.

The teachers toured NSMRL research facilities, including a walkthrough of the pool; Physiology Laboratory; the Sound Suite; and Chamber Room, where they were able to observe a CO<sub>2</sub> study in progress. The tour concluded with a discussion and demonstration of the research on audio/visual integration and the periscope.

“The goal of the program is to whet the appetite for knowledge and light the fire for understanding in a group of professional educators, who will touch the lives of thousands of students. We thank the NSMRL researchers for sharing their scientific knowledge and talents with us,” stated Frumento.



# NAMRU-Dayton Presents Research at 54th Annual Meeting of the Society of Toxicology

Story courtesy of NAMRU-Dayton Public Affairs

**Development of a Toxicokinetic Model for the Insensitive Munitions (IMX) Component 2, 4-Dinitroanisole**

Lisa M. Sweeney<sup>1</sup>, Michelle R. Goodwin<sup>2</sup>, Angela D. Hulan<sup>3</sup> and Chester P. Gut, Jr.<sup>2</sup>  
<sup>1</sup>Henry M. Jackson Foundation for the Advancement of Military Medicine, Naval Medical Research Unit, Dayton (NAMRU-D), Wright-Patterson Air Force Base (WPAFB), OH; <sup>2</sup>CAMRIS, NAMRU-D, WPAFB, OH; <sup>3</sup>Oak Ridge Institute for Science and Education, NAMRU-D, WPAFB, OH

**Abstract**  
 BACKGROUND: The Armed Forces have a need to develop new explosives that are less susceptible to unintentional detonation (insensitive munitions-IMX). It is important that military personnel and the community be protected from the potential risks to humans from these munitions. Toxicokinetic data for DNAN are required to understand the toxic effects of DNAN in exposed humans. **METHODS:** Male Sprague-Dawley rats were exposed to DNAN by gavage (0, 10, 25, or 50 mg/kg) in corn oil and blood and urine were collected from 0.5 to 24 h post-dosing. Blood and urine samples were analyzed for DNAN and its metabolite 2,4-dinitrophenol (DNP). These data and data from a previously published pharmacokinetic (PBPK) model were used to develop a preliminary model. **RESULTS:** On average, the model predicted values for the elimination half-life of DNAN in blood were 1.5 h, which is in good agreement with the observed values. The model also predicted values for the elimination half-life of DNP in blood were 1.5 h, which is in good agreement with the observed values. **CONCLUSIONS:** The PBPK model was developed to estimate the toxic effects of DNAN exposure in humans. The model was validated using data from rats and humans, showing the elimination of DNAN and DNP in blood and urine. The model was used to estimate the toxic effects of DNAN exposure in humans. The model was used to estimate the toxic effects of DNAN exposure in humans. The model was used to estimate the toxic effects of DNAN exposure in humans.

**Introduction**  
 Environmental and biological impacts of new munitions need to be assessed in a systematic manner to ensure that they are safe for use. The purpose of this study was to develop a toxicokinetic model for DNAN and DNP. The model was developed using data from rats and humans. The model was used to estimate the toxic effects of DNAN exposure in humans. The model was used to estimate the toxic effects of DNAN exposure in humans. The model was used to estimate the toxic effects of DNAN exposure in humans.

**Materials and Methods**  
**In vivo studies**  
 • A pilot study was conducted to determine the appropriate dose for the study.  
 • DNAN (0, 10, 25, and 50 mg/kg) and vehicle (corn oil) were administered to rats.  
 • Blood and urine samples were collected from 0.5 to 24 h post-dosing.  
 • DNAN and DNP were analyzed in blood and urine.  
**Pharmacokinetic model development**  
 • The model was developed using data from rats and humans.  
 • The model was used to estimate the toxic effects of DNAN exposure in humans.  
 • The model was used to estimate the toxic effects of DNAN exposure in humans.

**Results**  
 Table 1. Rat model performance: Concentration ratios of model predictions vs. experimental data (1 = perfect agreement)

Time (h)	DNAN (ng/ml)	DNP (ng/ml)
0.5	1.4 (16)	2.1 (7)
1	1.4 (16)	1.3 (4)
2	1.4 (16)	1.1 (2)
4	1.4 (16)	1.1 (2)
8	1.4 (16)	1.1 (2)
16	1.4 (16)	1.1 (2)
24	1.4 (16)	1.1 (2)

Table 2. Estimated human-equivalent doses (mg/kg) for a rat subchronic dose of 2.5 mg/kg for two intake scenarios, with two possible human gastrointestinal absorption rates.

Intake Scenario	Human Equivalent Dose (mg/kg)
Low (0.5)	0.5
High (1.0)	1.0

**Summary**  
 A PBPK model for DNAN and DNP in the rat was developed. The model was used to estimate the toxic effects of DNAN exposure in humans. The model was used to estimate the toxic effects of DNAN exposure in humans. The model was used to estimate the toxic effects of DNAN exposure in humans.

Dr. Lisa Sweeney presented her research on the Development of a Toxicokinetic Model for Insensitive Munitions (IMX) Component 2, 4-Dinitroanisole at the 2015 Society of Toxicology (SOT) held March 22 - 26 in San Diego. Dr. Sweeney is a Senior PBPK Toxicologist at NAMRU-D and has attended the annual SOT meetings since 1995. (Photo courtesy of NAMRU-Dayton Public Affairs)

DAYTON, Ohio - Scientists from Naval Medical Research Unit-Dayton's (NAMRU-D) Environmental Health Effects Directorate presented research during the 54th Annual Meeting of the Society of Toxicology (SOT) held in San Diego, March 22 - 26. The meeting brought together nearly 7,000 toxicologists from more than 50 countries to discuss recent advances and technologies in toxicological research.

NAMRU-D's Dr. Karen Mumy, Dr. Lisa Sweeney, Lt. Cmdr. Jennifer Mueller and Lt. Cmdr. Carlis Brown attended the SOT meeting.

NAMRU-D scientists teamed up with 711th Human Performance Wing/RHDJ U.S. Air Force scientists for an evaluation of the potential effects of Alcohol-to-Jet (ATJ) alternative jet fuels. The researchers determined the appropriate occupational exposure limits for these fuels are equivalent to those for traditional Air Force jet fuel (JP-8).

Mumy and Sweeney were authors or co-authors on two poster presentations, both of which described efforts done in conjunction with Department of Defense partners.

In collaboration with U.S. Army, Sweeney presented a poster, "Development of a toxicokinetic model for the insensitive munitions (IMX) component 2,4-dinitroanisole (DNAN)," in a session on biological modeling. IMX formulations are less

susceptible to unintentional detonation than conventional munitions, but their potential toxicological hazard to humans is unknown.

NAMRU-D scientists conducted studies to evaluate the absorption, distribution, metabolism, and elimination of DNAN and its more toxic metabolite 2,4-dinitrophenol (DNP) in a laboratory model. These data and similar data generated by the Army were used by Sweeney to develop preliminary physiologically based pharmacokinetic (PBPK) models of DNAN and DNP. The PBPK model was used to generate estimated human no-effect exposure levels for DNAN based on no-observed adverse effect levels determined in a laboratory model. The human no-effect levels may be used to guide the selection of occupational and environmental exposure limits for DNAN.

NAMRU-D's mission is to maximize warfighter performance and survivability through world-class aeromedical and environmental health research by delivering solutions to the field and the Fleet. The Environmental Health Effects Directorate conducts basic and applied research to assess the toxicity of chemical and materials used in military operations that may affect military populations. Researchers have the capability to study the toxic effects of materials using both *in vitro* and *in vivo* systems and then use the data to assess risk using modeling approaches. The results from these efforts have led to health protective exposure standards.

# NAMRU-3 Researcher Participates in Amman Workshop

Story courtesy of NAMRU-3 Public Affairs



Dr. Moustafa Abdel Fadeel (left) presents training to CPHL, Jordan (Photo courtesy of Dr. Abdel Fadeel)

CAIRO – Two researchers from the U.S. Naval Medical Research Unit – 3 (NAMRU-3) led a workshop at the Central Public Health Laboratory (CPHL), in Amman, Jordan, May 17– 20.

Dr. Mustafa Abdel Fadell and Mary Younan taught a four-day workshop as part of the Department of State-funded FY-14 project, “Capacity Building for Diagnosis and Safe Handling of Zoonotic Diseases in Jordan.”

Representing CPHL and Prince Hamza and Al-Basheer hospitals in Amman, 13 laboratorians and technicians participated in the training.

“Eagerness to get maximum understanding of what was right and what was wrong was very obvious,” said Younan. “The CPHL director and decision makers there cared enough to attend the training and pinpoint the gaps in their system to both the

attendees and the trainers.”

One of the topics covered was laboratory biosafety, including an introduction to the basic laboratory safety procedures, blood-borne pathogens, chemical safety and handling of laboratory waste. There were two practical sessions, which covered sample management and use of personal protective equipment, and spill control and handling laboratory waste.

A second topic was laboratory biosecurity, covering basic principles of biosecurity, biothreat and human errors, and the physical measures needed for secure and safe laboratory practices. Good Laboratory Practices (GLP) and the Laboratory Quality Management System (LQMS) were also discussed.

Following a theoretical introduction to polymerase chain reaction, there

was hands-on laboratory work on extraction methods and the use of reverse transcription polymerase chain reaction (RT-PCR) for molecular diagnosis of Crimean-Congo hemorrhagic fever (CCHF) and West Nile Virus (WNV) infections in human samples. Twenty serum samples from CPHL labs were used for the demonstration process.

“We enjoyed four, full days of training, moving between the lecture room for PowerPoint presentations, the serology lab for practical safety sessions and to the molecular unit labs for CCHF and WNV RT-PCR demonstration,” said Fadell. “We noticed high interest in the materials, especially in biosecurity, which was a totally new topic to many of them.”

Following the training, one of the participants commented, “while I was doing my work in the lab, I was always thinking about performing the testing rapidly to be able to send the report to the treating physicians. Although I still think the same way and will take care of the sample as before, now I will take care of myself as well and be careful not to get infected at the lab or take the infection home!”

Following the conclusion of the workshop, Fadell and Younan had a planning meeting with CPHL executives to discuss the next phase of the project. During the meeting, Dr Aktham Haddadeen, Undersecretary for Laboratory Affairs, expressed his appreciation of NAMRU-3’s support and continued scientific collaboration with CPHL, which enable the CPHL to have an up-to-date facility which is collaborating on several research projects with NAMRU-3 and other international organizations.



## R&D Chronicles

# The Problem of Paddy Foot: Navy Research and Immersion Foot Syndrome in the Vietnam War

By Andre B. Sobocinski, Historian, Bureau of Medicine and Surgery

"[Immersion Foot Syndromes represent]... the pathologic state which occurs after prolonged immersion in water and is a potentially serious problem. During one 'sweep and clear' operation in the month of December [1965] there were more cases evacuated from the field because of this problem than due to enemy action."

~~Capt. Gustave Anderson, MC, USN, 1967

As the Marines trudged through torrential rain, rice paddies and mud, many began suffering from a painful foot condition leaving them incapacitated for days, sometimes months. Removal of their boots revealed blistered, infected, swollen, ulcerated feet symptomatic of immersion foot syndromes.

By the time the conflict in Southeast Asia came around, immersion foot syndromes were nothing new in the history of warfare. Variations of the syndromes had taken on such infamous names as "trench foot" and "jungle rot."

In Vietnam it was sometimes termed "Paddy Foot" and "Wet Foot" by G.I.s and leathernecks. Its cause was prolonged exposure to wet environments. The severest cases could lead to loss of circulation in feet, gangrene and ultimately amputation and debridement.

Over the previous century, military doctors tried everything from chalk to whale oil to improved foot gear to keep this dreaded ailment in check. Some success was made during the Vietnam War in no small part to an enterprising Navy dermatologist named Capt. Gustave Anderson.

In 1965, at the request of Surgeon General Robert Brown, Anderson

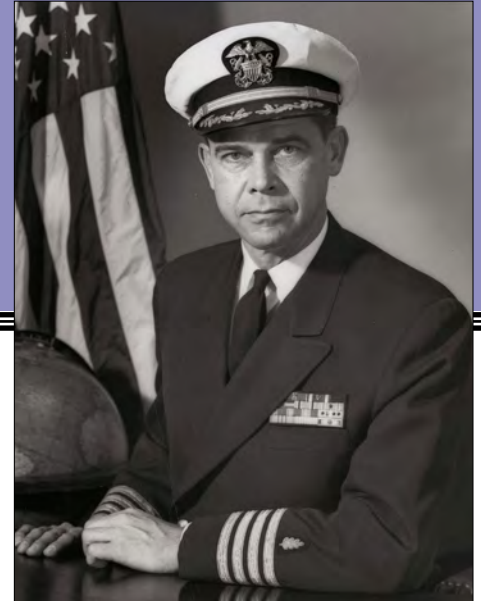
deployed to the Naval Station Hospital in Da Nang, South Vietnam to survey the dermatological disease situation. While there he was asked by Lt. Gen. L.W. Walt, Commanding Officer, III Marine Amphibious Force, to develop a prophylaxis for the immersion foot plaguing his troops.

When he returned stateside, Anderson sought out professional assistance from both military and civilian research specialists and private industry. Anderson determined that the Dow Corning Corporation, a leading supplier of silicone solutions, offered the best area for study.

With a medical investigating team from the Naval Field Medical Research Laboratory (NFMRL) in Camp Lejeune, North Carolina, Anderson devised and conducted investigations that demonstrated the feasibility of using a single daily application of silicone as a protective agent.

Pilot field tests utilizing silicone sprays, salves, powders and greases were conducted on volunteers from the 2d Marine Division by NFMRL from July to August 1966 at Camp Lejeune.

The tests found that out of the



*Capt. Gustave Anderson was a dermatologist who lead the way to explore the best prophylaxis for immersion foot syndromes plaguing troops in Vietnam. (Photo courtesy of Bureau of Medicine and Surgery Archives)*

54 treated subjects with silicone preparation, none acquired immersion foot in five days of a consistent wet environment. Out of 34 non-treated subjects, 98 percent developed immersion foot during the same period.

During his second tour of duty in Vietnam (November 13, 1966 and January 30, 1967), Anderson led a team of investigators for operational evaluation of silicone preparation or ointment in combat troops.

Anderson and his team demonstrated that through the use of the ointment, three-quarters of the anticipated immersion foot cases were prevented. Researchers also demonstrated that traditional methods of caring for ones feet—airing the feet in the sun or

*(continued on page 13)*

# NMRC Microbiologist Underway on USS Kearsarge

Blog by Lt. James Regeimbal, Naval Medical Research Center



*Lt. James Regeimbal pictured with the USS Kearsarge (LHD-3) Medical Department Sailors. Regeimbal was given the opportunity to go underway with the Kearsarge to witness firsthand the operations and duties of the Sailors assigned to the medical department. (Photo courtesy of Lt. James Regeimbal, Naval Medical Research Center)*

SILVER SPRING, Md. - The USS Kearsarge (LHD-3) is a Wasp-Class amphibious assault ship with both a large flight deck, and a well deck capable of amphibious launch and recovery. She also boasts the largest hospital capability afloat, aside from the two hospital ships, and a few weeks ago I was fortunate enough to go underway on one of her work-up cruises.

As a member of the Naval Medical Research Center (NMRC) Wound Infections Department my goal was to gain a better understanding of the kinds of trauma and infections that can occur during high-tempo ship's operations.

As researchers we are tasked with advancing products that fill capability gaps in operational settings, yet many of us never actually see those operational settings. Much can be gleaned from meeting with our intended end users and understanding the environments in which they work,

because there is a large difference between knowing at a cerebral level and knowing experientially.

For example, my work attempts to develop alternative therapeutics to treat multidrug resistant bacterial infections associated with very severe trauma. By going underway I realized a subtle bias in my thinking, which was that this kind of trauma only happens on a battle field.

Thus going underway adjusted my thinking on how to support the full range of operational needs of the modern Navy, but I also came away with so much more than that.

When I crossed the quarterdeck for the first time the hospitality of the ship was completely overwhelming and disarming. Everywhere I went I was welcomed and routinely asked to get involved and get dirty. I was able to visit every single department on the ship, from the bridge all the way down to main engineering.

I observed simultaneous well-deck and flight operations, which to the uninitiated looks like absolute chaos. MV-22s and all kinds of helicopters bounced on the flight deck, while AAVs and LCACs buzzed in and out of the well deck. The men and women of our fleet are amazing people who work long hard hours doing difficult and dangerous jobs, and for those of us charged with their care and readiness, they deserve our respect and our very best efforts.

As an Medical Service Corps (MSC) Microbiologist there are essentially no formal routes for us to get out with the fleet, so it is up to each of us to knock on doors and pound the pavement looking for opportunities. Otherwise, the fleet will remain foreign to us.

And if you catch a break, like the one I got when Hospital Corpsman Senior Chief Aaron Zale (SW/AW/FMF)/SFIDC, Leading Chief Petty Officer for Medical Department, generously offered to allow me a ride on the ship, you jump at the chance. And if you have an Executive Officer like Capt. Elizabeth Montcalm-Smith, who is now the Commanding Officer of Naval Medical Research Unit San Antonio, she will support you.

My time onboard reiterated to me that we are all in this together. We all wear the uniform of the U.S. Navy, and we all have a role to play that is critical to overall mission success. I am honored to play a small part in that mission, grateful for the opportunities thus far, and eager for more.



## The Problem of Paddy Foot: Navy Research and Immersion Foot Syndrome in the Vietnam War

(continued from page 11)



Hospitalman Eugene Latham works on the foot of a patient in the dermatology lab at Naval Station Hospital Da Nang, South Vietnam, because of the constant wetness in the fields of Vietnam medical personnel had to take special care of fighting men's feet. (Photo courtesy of Bureau of Medicine and Surgery Archives)

overnight—was advisable in helping to prevent the condition.

Anderson recommended that the ointment be used only when troops were “exposed to a constant wet environment more than 24 hours;” and be used by troops “actively engaged in an operation for only as long as the operation lasts.” Troops not exposed to extended periods in wet environment should not be treated.

The silicone ointment was not without some controversy. Many Marines complained that the original ointment was too “sticky” and “gummy.” The properties of ointment were eventually modified to improve its “cosmetic qualities.”

In his testimony to Congress in 1966, Commandant of the Marine Corps Gen. Wallace Greene called the silicone ointment one of the most significant innovations in use in Vietnam.

On March 9, 1967, Anderson was awarded the Legion of Merit for his work in helping to keep the feet of thousands of Marines protected from a preventable harm.

## NMRC and WRAIR Collaborate on Humanized Mice-DRAG and DRAGA

Story by Sai P. Majji, Naval Medical Research Center

SILVER SPRING, Md. - Naval Medical Research Center (NMRC) Infectious Diseases Directorate (IDD) held a seminar series where Dr. Sofia Casares, an investigator from IDD malaria group, along with Dr. Mangala Rao, an investigator from Military HIV research program at WRAIR presented significant advancements in the DRAG/DRAGA mice models in malaria as well as HIV research areas.

The recently characterized DRAG and DRAGA mouse models are among front runners of Human Immune System (HIS) humanized mice that have been demonstrated to efficiently reconstitute human immune cells like T cells and B cells. DRAG mice look like regular mice but once humanized are equipped with fully human immune system.

Casares, Dr. Sai Majji and Dr. Wathsala Wijayalath demonstrated that the DRAG mice, like humans, get infected when injected with live malaria sporozoites and develop malaria. Using the newer more-advanced DRAGA mouse model, the humanized mice malaria research team was able to demonstrate that DRAGA mice

can be protected from malaria, upon immunization radiation attenuated sporozoites and live sporozoites under chloroquine cover. Rao and her team, Dr. Atef Allam, Dr. Tina Peachman and Ms. Elaine Morrison, demonstrated that DRAG mice contain T follicular helper cells ( $T_{FH}$ ) that are susceptible to HIV infection. These findings were recently published in the Nature Scientific Reports journal. In brief, the researchers highlighted the various immune cells that are present in the intestinal tissue of the DRAG mouse and these cells are susceptible to HIV infection.

Dr. Carl Alving, Chief of the MHRP and Dr. Kevin Porter, Director IDD, profusely commended on the wonderful research findings and the progress of the scientific work by the two exemplary research teams.

Majji said humanized mice are a very powerful tool for researchers to conduct various pre-clinical studies, to test vaccines, small molecules and drug candidates, especially in the light of recent moratorium over non-human primate research and escalating costs of human clinical trials.

# Meet NAMRU-SA's 2015 NREIP Summer Intern, Ebony Miller

*Story courtesy of NAMRU-SA Public Affairs*

SAN ANTONIO - Ebony Miller, Navy reservist and second-year graduate student at San Diego State University (SDSU) in San Diego, was one of 75 graduate students selected to participate in a 10-week paid internship with the Naval Research Enterprise Intern Program (NREIP).

Miller's internship will be in conjunction with the Naval Medical Research Unit San Antonio's (NAMRU-SA) Department of Biomaterials and Environmental Surveillance. She will work under the guidance of Dr. Amber Nagy and Nagy's Immunologist and Lead Technician, Ms. Ann Marie Foushee.

Miller's project will focus on the potential health effects associated with inhaled dental laboratory materials. Specifically, she will test the biocompatibility of dental materials that contain nano-sized particles (particles with 1 dimension less than 100 nanometers in size).

The use of nanoparticles in dental materials is becoming more common place since material size can enhance parameters such as strength and durability. However, the biological response associated with exposure to nanoparticles is lesser known. The size-dependent effects that can improve material performance must also be safe for humans and the environment.

To understand these effects, Miller will characterize the size, charge and agglomeration of nanomaterials that are frequently used in dental laboratories to make molds and casts of teeth. She will also learn cell culture, viability assays and how to measure inflammatory proteins in response to exposure to dental dusts. The goal of her project is to help answer the question: *do nanodusts contained in dental materials have an effect on bronchial airway cells?*

Miller's research will set the stage for future studies where real-time air samples will be collected from fully operational dental laboratories. In this project, air will be sampled and the nano-fraction will be



*During her NREIP Internship at NAMRU-SA, Ms. Ebony Miller will gain valuable laboratory experience that she can carry with her as she finishes her master's degree in Public Health at San Diego State University, San Diego. (Photo by Flisa Stevenson, NAMRU-SA Public Affairs)*

characterized by size and composition so better laboratory simulations can be conducted. The research project will hopefully supplement ongoing hazard and risk assessments with respect to indoor nanoparticle exposure.

Nagy and her team plan to introduce Miller to the nuances of scientific research by immersing her in daily lab tasks, as well as other research experiences including familiarizing her with scientific research articles, the Internal Review Board Process, and Biosafety Level II training. It is NAMRU-SA's intention that Miller will gain valuable laboratory experience that she can carry with her as she finishes her master's degree in Public Health.

Miller's transition to laboratory science will be an exciting one as she graduated from the United States Naval Academy, Annapolis, in 2007 with a Bachelor of Science Degree in Political Science with a concentration in international relations. She served as a Surface Warfare Officer, as an active duty officer, for seven years prior

to pursuing her interests in environmental health and sciences.

Miller is a native of Riverside, California, and once the internship is complete, she will be returning to SDSU to finish her degree. After completing her degree, Miller wants to go back on active duty and be re-designated into the Medical Service Corps as an Environmental Health Officer.

The Naval Research Enterprise Intern Program is sponsored by the Office of Naval Research and is a 10-week intern program designed to provide opportunities for undergraduate and graduate students to participate in research, under the guidance of an appropriate mentor, at a participating Navy laboratory.

To culminate her 10 weeks at NAMRU-SA, Miller will be making a poster of her research and presenting it to the NAMRU-SA Command.



# NAMRU-6 Entomology Team Wins Top Scientists Award

Story courtesy of NAMRU-6 Public Affairs



(Left to right) Anibal Huayanay, Victor Lopez, Karin Escobedo, Miguel Vasquez and Geidín Chavez. (Photo courtesy of NAMRU-6 Public Affairs)

LIMA, Peru -In a ceremony at the Pentagon, the U.S. Naval Medical Research Unit 6's (NAMRU-6) *Anopheles darlingi* colonization team was presented with the 2014 Delores M. Etter Top Scientists and Engineers group award, presented by the Assistant Secretary of the Navy for Research, Development and Acquisition, the Honorable Sean J. Stackley, June 12.

The NAMRU-6 Entomology Department conducts research focused on protecting deployed troops including testing novel vector control techniques, and on designing Integrated Vector Management programs, personal protective measures, insecticide resistance and pathogen diagnostic assays.

As part of its research into preventing malaria in deployed troops, the department established the first in

the world self-sustaining colony of the malaria vector *Anopheles darlingi*. Over the last 20 years, this species has become the most important malaria vector in the Amazon region with numerous failed attempts at establishing a colony. This colony will facilitate the production of the malaria parasite which is critical to the DoN/DoD efforts to develop a vaccine against this ancient and deadly foe. In addition to helping the U.S. military this colony will serve as a regional resource for scientists to assist in improving the ability of regional governments to control malaria in local populations.

The team consists of Dr. Gissella Vasquez and Dr. Carmen Flores based in Lima; Victor Sifuentes, Karín Escobedo, Geidín Chavez, Miguel Vasquez, Luz Romero, Anibal Huayanay and Hugo Jaba based in Iquitos.

"I am very proud of all the hard work of everyone involved in the project and it was a real honor to receive the award," said Vasquez, the team leader. "The ceremony was excellent and I am excited about the future products the colony will help develop for the U.S. Navy and the people of Peru."

The colony is already being used to produce malaria sporozoites in collaboration with the malaria program at the Naval Medical Research Center, Silver Spring, Maryland, and the future looks bright for future scientific breakthroughs.

"We expect the colony and the many applied and basic experiments it will allow us to conduct will be a core function of the Entomology Department for the next 10 years," said Lt. Cmdr. Craig A. Stoops, entomology department head.